HELICOPTER TRANSMISSION FLUID PURIFICATION UNIT
PREPRODUCTION INITIATIVE
TEST PLAN

SITES: NAS JACKSONVILLE AND NAVAIR PATUXENT RIVER

1.0 OBJECTIVE

The objective of this Pollution Prevention Equipment Program (PPEP) Preproduction Initiative is to determine the feasibility of purifying used helicopter transmission oil for later reuse in aircraft.

This test plan describes the data collection procedures for testing a portable oil filtering system at the Fuels and Lubricants Division located at Naval Air Warfare Center Aircraft Division Patuxent River (NAVAIR PAX) and at Naval Air Station Jacksonville (NAS JAX). This system will be tested for its ability to remove particulates and water from MIL-L-85734 (helicopter transmission oil) without damaging the fluid properties. If successful, the oil contaminated with particulates and water will be purified and available for reuse (following verification of its quality) rather than requiring disposal as used oil or a hazardous waste. Specifically, the unit will be evaluated on its ability to:

- Reduce the quantity and cost of oil disposal.
- Reduce the requirement for procurement of new oil.
- Extend helicopter equipment life.

In addition, this test plan describes the data collection procedures for testing a portable water-in-oil analyzer (water analyzer) at NAS Jacksonville. The water analyzer is being evaluated under a separate initiative (Water-in-Oil Analyzer Preproduction Initiative); however, the initial assessment of the unit will be performed in conjunction with the Helicopter Transmission Fluid Purifier Preproduction Initiative described here. Specifically, the analyzer will be tested for its ability to determine water content in purified MIL-L-85734 (helicopter transmission oil). If successful, the ability to determine the concentration of water in the oil in the fleet will provide users and maintainers a better feel for the health of the oil. With the coordination and concurrence of the Navy Oil Analysis Program (NOAP), use of the water analyzer will reduce the number of purified oil samples that require laboratory analysis of water content. The unit will be evaluated on its ability to:

- Accurately determine the concentration of water in purified transmission oil
- Reduce or eliminate labor associated with the laboratory analysis of purified oil
- Reduce the quantity and disposal cost of hazardous waste generated by traditional laboratory water measurement methods
- Reduce turnaround time associated with laboratory analysis of samples.

Testing under the Helicopter Transmission Fluid Purification Unit (HTFPU) initiative will be conducted in two phases. Phase I will consist of a laboratory verification of the purification system conducted at the Fuels and Lubricants Division at NAVAIR PAX. Phase II will be conducted at NAS Jacksonville and will include evaluations of the operational effectiveness of both the HTFPU and the water analyzer.

2.0 DESCRIPTION

As part of the Navy's ongoing effort to eliminate waste and reduce pollution, the SH-60 aircraft went through an Oil Life Extension Program from 1990-1993. The program, conducted by the Fuels and Lubricants Division (AIR-4.4.5) at NAVAIR PAX and the SH-60 Aircraft PMA, doubled the oil drain interval for the main transmission system from 450 to 900 hours. The Lubricants group within the Fuels and Lubricants Division is the Cognizant Field Activity (CFA) for all Navy aviation propulsion system lubricant issues. The Lubricants group also has the responsibility of accepting and certifying for use all aviation lubrication-related equipment and procedures. In an effort to further reduce oil waste resulting from oil changeouts, PPEP is examining the possibility of recovering helicopter transmission oil for reuse.

Currently, used oil is drained from the helicopter transmission system after a specified number of flight hours for each particular helicopter type or after a maintenance indication. After it is drained, the transmission system is filled with new oil and on some occasions drained again (e.g., when switching between specs or when oil analysis results indicate that a flush of the system is recommended). The spent oil must then be disposed of (either as hazardous or used oil waste, depending on local regulations and procedures). Because both the contaminated oil and the oil used to flush the system must be discarded, the total volume of waste generated during one changeout is as much as twice the capacity of the transmission system. For example, the SH-60 main transmission is currently drained after every 900 hours of operation and, although it holds approximately 7.5 gallons of oil, as many as 15 gallons of waste oil must be disposed of during each changeout. Following the flushing of the system and the performance of any required maintenance procedures, the system is filled with new oil and returned to operation. In addition to the main transmission, the intermediate gearbox, which holds approximately 1 quart of transmission oil, and the tail gearbox, which holds approximately 1 ½ quarts, are both drained, flushed (when necessary), and refilled after every 450 hours of flight time. These changeouts generate a minimum of approximately 1¼ to 2½ additional gallons of waste oil for each 900 hours of flight time.

The primary contamination problem of the helicopter transmission oil is its tendency to absorb water, which subsequently breaks down the properties of the transmission oil. Water can enter through physical intrusion as well as through condensation of atmospheric humidity. When a helicopter is operating over water or at sea, water intrusion—more specifically, saltwater intrusion—is an even greater possibility. The purification and subsequent reuse of used transmission oil would reduce waste generation and, potentially, operating costs for both shipboard and land-based aircraft. Furthermore, the availability of an accurate system for determining the level of water contamination of

oil in the fleet would allow purified oil to be returned to service more quickly and reduce the need for laboratory analysis of water content in purified transmission oil. Additionally, the results may indicate that transmissions may be drained based on the quality of the oil and not on hours of aircraft operation. This may increase the interval between transmission drains and reduce labor and waste associated with oil drains.

3.0 TEST PLAN

This test plan is designed to collect data that will be used to evaluate the efficiency, effectiveness, and performance of the HTFPU and the water analyzer, as well as determine their compatibility with Navy operations. The test plan will also quantify the capital and operating costs of the systems, the waste reductions achieved, and the amount of purified transmission oil recovered for reuse. These figures will then be used to gain an accurate picture of the costs and benefits that would be expected following fleet implementation of a transmission oil recovery program that uses one or both of these units.

The VP30-1S portable filtering system, manufactured by Allen Filters, Inc., has been selected for evaluation during the purification portion of this test. The unit will be tested during both phases of the program. It is anticipated that certain design modifications (based on feedback from Phase I of the test) will be implemented on the HTFPU before Phase II commences. This unit is designed to process 30 gallons of helicopter transmission oil per hour. Depending on the filter cartridge selected, the system can remove solids, sludge, and/or free and emulsified water. The Allen system has dimensions of 19” x 19” x 46” and weighs approximately 145 pounds. The following components are included with the Allen VP30-1S portable filtering system:

- Two cartridge filters
- One Viking positive displacement rotary gear pump
- One ¼-hp motor, completely enclosed, fan-cooled, rated for 1725 revolutions per minute (rpm), 115/230V, 60 Hz, and single-phase power supply (currently wired for 115V)
- ½” National Pipe Thread (NPT), schedule 40, carbon steel piping
- Components positioned on a portable steel cart
- Two hoses with abrasion-resistant covers and quick-release fittings for suction and discharge
- Power cable.

One water analyzer, manufactured by Pall Aeropower Corporation, has been selected for evaluation in the water analysis portion of this test. The WS04 portable water analyzer will be used. The Pall unit will be tested during Phase II of the program only. This hand-held unit has dimensions of 4.6” x 8.5” x 3.0” and can be programmed to display water concentration in parts per million (ppm) for a specific type of oil. The probe attached to the water analyzer will be used to obtain snapshot readings of the water concentration in the oil.

If repairs to the HTFPU or water analyzer are required at any time during either Phase I or Phase II, they must be arranged through PPEP—not through the vendors. Call Donna Switzer (856-667-6770) or Raymond Wendrzycki (732-323-1666 or DSN 624-1666) if any consumables or repairs are required for the HTFPU or the water analyzer.

3.1 Phase I Approach

Phase I of the test plan involves laboratory verification of the HTFPU's performance and its effects on the oil. AIR-4.4.5, the CFA for aviation lubrication, will conduct this phase of the test. During Phase I, used oil samples collected from fleet operations will be sent to AIR-4.4.5 for purification and testing. Having the lubricant CFA perform this laboratory verification should allow for accelerated program acceptance and the necessary permission to test the equipment at active sites during Phase II. ***At no point during either phase will purified oil from these tests be returned to any aircraft. After purification, the oil is to be handled and disposed of in accordance with local procedures.***

Concurrent with Phase I, the SH-60 is undergoing an oil sampling program to verify the effectiveness of the oil drain interval extension program described in Section 2.0. Ten aircraft from each helicopter wing (HL and HSL) on each coast are being sampled. As part of the Phase I testing, five samples from each aircraft will be collected in conjunction with the 900-hour main transmission oil drain. These samples will be taken from the main transmission, the intermediate and tail rotor gearboxes, and each engine. Main transmission samples are 5 to 7 gallons (sump size is 7 1/2 gallons) and will be the primary samples used in the purification evaluation. Samples from the intermediate and tail rotor gearbox may be used to evaluate smaller volumes. A representative group of SH-60 program samples will be sent to AIR-4.4.5 for condition testing. These samples will be available for PPEP's use after the condition analysis is completed for the SH-60 program. This condition analysis will provide baseline data for the initial condition of the used transmission oil.

After the condition analysis is completed, the samples will be purified using the HTFPU. Following purification, the samples will be re-tested to determine the effectiveness of the process. The data will be recorded each time a sample is run through the HTFPU. All data will be recorded on the data sheets specified in this test plan. The purification and condition testing processes will be repeated six times or until no further improvement in oil condition is observed. The physical testing process will be the same for each sample run through the HTFPU.

Also as part of Phase I, additional samples will be "spiked" with varying quantities of water to evaluate the HTFPU against the current fleet limit for water in oil [1000 parts per million (ppm)]. The purification of the spiked samples will aid in determining the expected filter life span.

AIR-4.4.5 personnel will evaluate the following physical properties of the transmission oil:

- Water content (ppm)
- Sediment (milligrams/liter [mg/L])
- Viscosity (centistokes [cSt] at 40^{o}C and 100^{o}C)
- Total acid number (TAN) (mg/g KOH)
- Wear metal content (ppm).

Based on the results of these tests, additional physical properties will be tested and certain wear tests will be performed on selected sample(s). Possible tests include, but are not limited to: flash point, additive concentrations, foam volume, oxidation/corrosion and thermal stability/corrosivity, and the 4-ball wear test. Depending on the type and number of additional tests selected, samples may be combined to provide a volume large enough to perform the test(s).

Notes:

1. Water content is checked to determine the amount of water in the oil. Excessive amounts could lead to internal corrosion and hydrolysis of the oil.
2. Sediment testing is used to determine the amount of particulate matter in the oil.
3. Viscosity and TAN are basic properties that are measured to get a general idea of the physical conditions of the oil.
4. Wear metal content is used to determine the health of engine and transmission components by measuring the metals generated during operation.
5. The flash point of a sample is checked to determine if there is any gross contamination of the transmission fluid by any other fluid/oil. For example, contamination by mineral oil-based hydraulic fluid can result in a decrease in flash point.
6. Additive concentrations are checked with high performance liquid chromatograph (HPLC) and gas chromatograph (GC) to determine the protective capabilities of the oil (e.g., antioxidant and anti-wear properties) relative to new oil values.
7. Foam volume is checked to determine the oil's propensity to foam under certain operating conditions.
8. Oxidation/corrosion and thermal stability/corrosivity testing is performed to determine the oil's oxidative stability and resistance to metal attack at various temperatures and oxygen concentrations.
9. 4-ball wear testing is used to give a general idea of the oil's wear preventative characteristics.

3.1.1 Instructions for Completing Table 1 (Purification Data Sheet - Phase I Laboratory Testing Only)

Table 1 will be used by AIR-4.4.5 personnel during Phase I of the testing. Each data sheet will correspond to one specific sample and all purification runs and testing for that sample.

- **Date:** Indicate the date on which the purifier was operated (month/day/year).

- **Operator(s):** Enter the name(s) of the individual(s) who performed the testing.

- **Volume:** Check the box that applies to the volume of the sample that will be run through the Allen portable filtering system. If the sample is greater than 15 gallons, check "Other" and write in the amount that will be purified.

- **Final Pressure:** Toward the end of the final purification cycle (while the unit is still running), record the pressure on the two gauges of the HTFPU. The upper gauge (near the top of the unit) measures the fluid pressure before the fluid enters the filter. The lower gauge (near the bottom of the unit) measures the fluid pressure after the fluid leaves the filter. The difference between the two pressures (ΔP) is an indicator of both the life remaining in the filter and the filter's performance. A high ΔP (35 lb.) denotes a clogged filter that may need to be replaced. The two gauges must be read and recorded in pounds per square inch (psi).

- **Purification Sample ID:** Enter the designated sample ID. Each sample ID should be unique and will be carried through on the same data sheet for the entire duration of the sample life. **Note:** In addition, the purification sample ID name and run number (e.g., PurTest 1-1, PurTest 1-2, PurTest 1-3, etc.) should correspond to the number of passes through the filtering system.

- **Time:**
  - **Start:** Indicate the time the HTFPU was turned on and began filtering.
  - **End:** Indicate the time the HTFPU was turned off and stopped filtering.

- **No. of Passes Through Filter:** Record the consecutive number of passes for the oil being purified. A pass is considered one complete cycle through the HTFPU. **Note:** The purification and condition testing processes will be repeated a total of six times, or until no further improvement in oil condition is observed.

- **Operator Comments:** List any comments, general and specific, that pertain to the condition of the purification system, how it is running, how it could be improved or made more efficient, and any other applicable/relevant comments.

- **Physical Testing Results:** On a separate sheet, record all results of the physical condition testing of the main transmission oil samples (conducted after purification through the Allen portable filtering system). Also, indicate whether the samples passed or failed each criterion. Attach a copy of all results for each sample to the

corresponding data sheet. **Note:** The purification sample ID on the condition test results will be the same as the one used on the purification data sheet.

3.2 Phase II Approach

During the second phase, used transmission oil will be purified by NAS Jacksonville personnel and then sent to AIR-4.4.5 for verification of fleet operation of the purification unit. During fleet trials at NAS Jacksonville, a Pall portable water analyzer will be used to determine the concentration of water in the "as drained" and the purified oil. Initially, **only oil from the main gearboxes** will be purified. Based on operational data, the tail and intermediate gearboxes may be included at a later date.

During the test period, NAS Jacksonville personnel will also be responsible for collecting operational and performance data that will be used to determine the cost effectiveness, reliability, and ease of use of the HTFPU and the water analyzer. To accomplish this, NAS Jacksonville personnel will fill out a data collection sheet each time the HTFPU and/or water analyzer are used and on those days that the HTFPU and/or water analyzer are being repaired or maintained. All data will be recorded on the Oil Purifier/Water-in-Oil Analyzer Data Sheet in this test plan (see Table 2).

When a helicopter transmission is scheduled to be drained, the oil shall be collected in the 5-gallon closed-top cans that have been provided. For the purposes of this test plan, the collected oil shall be called an "oil sample." After the oil has been collected, at least two specimens will be collected in the ½-gallon sample cans provided. The ½-gallon sample cans will be packaged into the shipping containers provided and sent to the Fuels and Lubricants Division located at Naval Air Warfare Center Aircraft Division Patuxent River (NAVAIR PAX). For the purposes of this test plan, the ½ gallon samples shall be called "laboratory samples" or "lab samples."

During fleet trials of the purifier unit at NAS Jacksonville, oil samples from the main transmissions of various helicopters will be purified and labeled based on their collection date. Only one helicopter drain at a time will be purified, even if multiple helicopters are drained on the same day. Purification and onsite water analysis of drained oil should be performed every day that oil is drained from a helicopter. Two laboratory samples will be collected from each oil sample: one before purification and the second after purification (typically the third pass).

The following procedure will be used for the purification, analysis, and sampling of the oil. After a main transmission is drained and collected, it will be mixed thoroughly (shaking/agitating the container is sufficient). A lab sample (approximately a ½-gallon) of this oil will then be collected and assigned a lab sample ID based on the date that the lab sample was created. For example, a lab sample that was collected on 7 May 2002 will be given the ID of 050702-U (MMDDYY, the U stands for unpurified), along with the tail number of the aircraft from which it was drained. This ID will be written on a labeled oil sample can and the lab sample will be placed in the bottle. Lab sample cans, shipping containers, and instructions will be provided by AIR-4.4.5. The operator will

then use the hand-held water analyzer to determine the concentration of water in the lab sample for recording on the Oil Purifier/Water-in-Oil Analyzer Data Sheet by submerging the analyzer portion of the probe in the lab sample bottle and lightly stirring until the numerical reading is stabilized (fluctuating within $\pm$10ppm). Following each day's operations, the hand-held water analyzer probe must be cleaned according to the manufacturer's directions.

Each oil sample will then be passed through the purifier unit three times. After each pass, operators will use the water analyzer to determine the concentration of water in the purified oil by submerging the analyzer portion of the probe in the purified oil collected from the outfall of the filtering system. Immediately following the third pass, the operator will collect a lab sample of this portion of the purified oil. The lab sample will be assigned a lab sample ID based on the collection date and the number of passes through the purification unit. For example, a lab sample collected on 7 May 2002 after the third pass through the purification system will be given the ID 050702-3P. This ID will be written on a labeled sample can along with the tail number of the aircraft from which it was originally drained. The operator will use the water analyzer to measure and verify the water content of the oil within the lab sample can. This reading will be recorded on the lab sample can label and the Oil Purifier/Water-in-Oil Analyzer Data Sheet. When all three passes have been completed and both lab samples have been collected, labeled and measured, the purifier will be secured and the remaining oil sample handled in accordance with base procedures. The purifier unit will not be drained. The two lab samples (purified and unpurified) will then be packaged and shipped to AIR-4.4.5, Fuels and Lubricants Division, NAVAIR PAX, in accordance with specifications in the operating procedures (attached). ***At no point will any oil from these tests be returned to any aircraft. After purification, the oil is to be handled and disposed of in accordance with local procedures, unless the entire oil sample is requested by NAVAIR PAX.***

On some occasions (date to be determined) during the test period, the Fuels and Lubricants Division at NAVAIR PAX will request that the purified oil remaining after the collection of a purified lab sample be collected and shipped to NAVAIR PAX for performance testing in the Drive Systems test cell. Shipping instructions will be provided at that time.

Because a minimum of approximately 20 gallons of transmission fluid would be required for NAVAIR PAX performance testing, it may be necessary to create a composite test sample. NAVAIR PAX will create this 20-gallon composite by collecting the total purified oil after the final pass through the purifier at JAX. Upon notification from NAVAIR PAX and/or PPEP, NAS Jacksonville will send the total volume of purified oil to AIR-4.4.5, Fuels and Lubricants Division, NAVAIR PAX, in accordance with specifications. This oil will be stored at PAX in a secure area. No other fluid type will be combined with the collected test samples. When a sufficient volume of transmission fluid has been collected, the composite oil sample will be run through the HTFPU at NAVAIR PAX.

If AIR-4.4.5 laboratory testing of the associated lab samples shows that the purified oil meets the specifications for MIL-L-85734, the test sample will be used in a test gearbox in the helicopter test cell operated by the Drive Systems unit. This gearbox will then be operated to assess the oil's performance in a controlled, real-life situation.

Aside from this exception for performance testing, the sample collection, purification, and analysis procedures will remain the same throughout the test period.

3.2.1 Instructions for Completing the Oil Purifier/Water-in-Oil Analyzer Data Sheet (Table 2)

The attached Oil Purifier/Water-in-Oil Analyzer Data Sheet will be used by NAS Jacksonville personnel to record usage data for the purification and analysis units. During the test period, the data sheet will be completed every day that the HTFPU and/or water analyzer is used and on those days that the HTFPU and/or water analyzer is being repaired or maintained.

- **Date**: Indicate the date (month/day/year) on which the oil sample was run through the purifier.

- **Operator(s) and Squadron**: Enter the name(s) of the individual(s) and the squadron performing the testing.

I. Aircraft Information

- **ACFT Model and Tail No**: Enter the aircraft model and tail number from which the oil sample was taken.

- **XMSN S/N**: Enter the serial number on the transmission of the aircraft from which the oil sample was taken.

- **Oil Drain Date**: Enter the date on which the oil was drained from the transmission.

- **Time Since Overhaul and Oil Change**: Enter the amount of time since an overhaul and an oil change were performed on the equipment.

II. Purifier Equipment Usage Data

- **Volume of Oil Sample Processed**: Enter the volume (in gallons) of the oil sample that will be run through the HTFPU. Does this volume include the unpurified laboratory sample volume collected?

- **Start Time**: Using military time, indicate the time the purifier unit was turned on and began filtering (i.e., beginning of first pass).

- **Upper Pressure and Lower Pressure**: Toward the end of the test's third purification pass (while the unit is still running), record the pressure on the two gauges of the HTFPU. The upper gauge (near the top of the unit) measures the fluid pressure before the fluid enters the filter. Enter the value from this gauge on the Upper Pressure line. The lower gauge (near the bottom of the unit) measures the fluid pressure after the fluid leaves the filter. Enter the value from this gauge on the Lower Pressure line. The difference between the two pressures (ΔP) is an indicator of both the life remaining in the filter and the filter's performance. A high ΔP (35 lb.) denotes a clogged filter that may need to be replaced. The two gauges must be read and recorded in psi.

- **Finish Time**: Using military time, indicate the time the purifier unit was turned off and stopped filtering (i.e., end of third pass).

- **Was the HTFPU operating properly?**: This question refers to whether the HTFPU was not used because it was undergoing repairs, normal maintenance, or filter replacement. If the equipment is not operating properly and the drained oil cannot be purified, save the unpurified oil in a secure location until the unit has been serviced. Describe the failure in the space provided and complete Table 3 – Maintenance and Repair Log. **NOTE:** ***If the HTFPU requires repairs, the repairs should be arranged through Donna Switzer, UTRS (856-667-6770), or Raymond Wendrzycki, NAVAIR Lakehurst (732-323-1666 or DSN 624-1666).***

III. Water-in-Oil Analyzer Usage Data

- **Water Reading**: Enter the value that was displayed by the hand-held water analyzer. This value is the water content of the oil in ppm. Enter one value for each analysis that was performed (i.e., unpurified lab sample, after each purification pass, and the purified lab sample).

- **Lab Sample ID**: Enter the laboratory sample ID number. The ID consists of the calendar date, in MMDDYY format, followed by a code of U or xP. "U" stands for an unpurified lab sample and "P"for a purified lab sample. The "x" is the number of passes through the purifier, usually three unless otherwise directed. This number should be the same number that is put on the laboratory sample container.

- **Was the water analyzer operating properly?**: This question refers to whether the water analyzer was not used because it was undergoing repairs or normal maintenance. If the equipment is not operating properly and a reading cannot be taken, the oil should still be purified and lab samples collected and sent to the laboratory. Describe the failure in the space provided and complete Table 3 – Maintenance and Repair Log. **NOTE:** ***If the water analyzer requires repairs, the***

repairs should be arranged through Donna Switzer, UTRS, or Raymond Wendrzycki, NAVAIR Lakehurst.

Operator Comments and Suggestions Regarding the HTFPU and the Analyzer

Comments should focus on explaining any problems, repairs, when and what maintenance was performed to the purifier system, costs incurred, and any comments or suggestions about the purifier system's effectiveness and efficiency. In addition, list any comments, general and specific, that pertain to the condition of the water analyzer, how it is running, how it could be improved or made more efficient, and any other applicable/relevant comments.

3.2.2 Instructions for Completing Maintenance and Repair Log (Table 3)

When an equipment failure occurs, complete Table 3 – Maintenance and Repair Log.

If the failure or scheduled maintenance occurred while processing an oil sample, complete the following:

- **ACFT Tail No**: Enter the tail number of the aircraft from which the oil sample was taken.

- **XMSN S/N**: Enter the serial number on the transmission of the aircraft from which the oil sample was taken.

- **Laboratory**: Enter the name of the lab conducting the analysis when the failure or scheduled maintenance occurred while an oil sample is being processed at a NOAP laboratory.

If the failure or scheduled maintenance occurred unrelated to processing an oil sample, indicate N/A in the previous sections and complete the following:

- **Date**: Enter the date on which the failure or scheduled maintenance occurred.

- **Unit**: Indicate which unit failed or required scheduled maintenance: the HTFPU or the water analyzer.

- **Description:** Describe the repair or maintenance performed.

- **Equipment Downtime:** Indicate how many hours the equipment was not operational.

- **Parts Required:** Indicate the parts required to fix or maintain the equipment

- **Scheduled Maintenance:** Was this a scheduled maintenance? The maintenance schedule can be found in the manufacturer's operating manual.

- **Time Spent:** How many man-hours were spent correcting the problem or performing scheduled maintenance?

4.0 REPORTING

The Oil Purifier/Water-in-Oil Analyzer Data Sheet and the Maintenance and Repair Log should be completed every day that the HTPFU and water analyzers are used, checked, and/or serviced. Data sheets should be faxed as completed or on a monthly basis, at a minimum, to Raymond Wendrzycki at 732-323-4917 (fax) and 732-323-1666 or DSN 624-1666 (voice) and Donna Switzer at 856-667-7586 (fax) and 856-667-6770 (voice). The final report will include detailed results and observations, assess the efficiency and cost-effectiveness of the unit, and evaluate its transferability to operational squadron sites.

TABLE 1
PURIFICATION DATA SHEET
PHASE I LABORATORY TESTING ONLY

Date: _____
Operator(s):_____

Volume

- ☐ 5 gallons
- ☐ 7 gallons
- ☐ 10 gallons
- ☐ 15 gallons
- ☐ Other_____

Final Pressure

Upper_____
Lower_____

OPERATING CHARACTERISTICS

Purification Sample ID	Start Time (24-Hour Clock)	End Time (24-Hour Clock)	No. of Passes Through Filter

Operator comments: _____
_____
_____
_____

Physical Testing Results: Attach a copy of all results to this sheet.

TABLE 2
OIL PURIFIER/WATER-IN-OIL ANALYZER DATA SHEET
PHASE II FLEET TESTING ONLY

Date: _____ Operator(s): _____
Squadron: _____ Operator(s): _____

I. Aircraft Information

ACFT Model: _____ Oil Drain Date: _____
ACFT Tail No.: _____ Time Since Overhaul: _____
XMSN S/N: _____ Time Since Last Oil Change: _____

II. Purifier Equipment Usage Data

Volume of oil sample processed (gallons): _____

Start Time: _____ Finish Time: _____

Upper Pressure (psi): _____ Lower Pressure (psi): _____

Was the HTFPU operating properly (circle one)? **Yes** **No**.
If the equipment was not operating properly, complete Table 3 – Maintenance and Repair Log.

Description of Failure: _____

III. Water-in-Oil Analyzer Usage Data

	Unpurified	**Pass 1**	**Pass 2**	**Pass 3**
Water reading (ppm)				
Lab sample ID				

Was the water analyzer operating properly (circle one)? **Yes** **No**
If the equipment was not operating properly, complete Table 3 – Maintenance and Repair Log.

Description of Failure: _____

Operator Comments and Suggestions: _____

_____

Add additional sheets as necessary

Fax to: Raymond Wendrzycki (732-323-4917) and Donna Switzer (856-667-7586)

TABLE 3
MAINTENANCE AND REPAIR LOG

ACFT Tail No.* _____ Laboratory:** _____

XMSN S/N:* _____

Date	Unit (HTFPU, water analyzer)	Description	Equipment Downtime (hours)	Parts Required	Scheduled Maintenance (Y or N)	Time Spent (Man-hours)

*This information is required only if the failure or scheduled maintenance occurred in relation to processing an oil sample.
**This information is required only if the failure or scheduled maintenance occurred while being used at the NOAP Laboratory.

NOTE: If the HTFPU or the water analyzer requires repairs, they should be arranged through Donna Switzer, UTRS, Inc. (856-667-6770) or Raymond Wendrzycki (732-323-1666 or DSN 624-1666).

Fax to Raymond Wendrzycki (732-323-4917) and Donna Switzer (856-667-7586)